Missouri Department of Natural Resources

BIOLOGICAL ASSESSMENT AND HABITAT STUDY

Honey Creek
Grundy and Livingston Counties

September 2005 – March 2006

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**), Water Protection Program (**WPP**), the Environmental Services Program (**ESP**), Water Quality Monitoring Section (**WQMS**) conducted a macroinvertebrate bioassessment and habitat study of Honey Creek in Grundy and Livingston Counties in north central Missouri. Approximately 23 miles of Honey Creek in Grundy and Livingston Counties are included on the 2002 303(d) list for sediment pollution from agricultural nonpoint sources. Although habitat loss is not an impact that is consistent with the 303(d) list, habitat was studied because there are extensive segments of Honey Creek that have been channelized and have vertical banks and/or poor riparian zones. This survey assessed 23 miles of Honey Creek in Grundy and Livingston Counties from the confluence of the Thompson River to Section 29, Township 63 North, Range 23 West. The 23 miles of Honey Creek addressed in this study are listed as Class C waters, water body I.D. #0554 (MDNR 2005c), and constitute the entirety of the listed segment.

1.1 Purpose

The purpose of the study was to determine if the Honey Creek biological community is impaired and, if so, determine potential causes.

1.2 Objectives

1) Characterize the physicochemical characteristics of Honey Creek.
2) Characterize the habitat characteristics of Honey Creek.
3) Determine if the macroinvertebrate community of Honey Creek is affected by factors related to habitat loss.

1.3 Tasks

1) Conduct physicochemical monitoring of Honey Creek.
2) Conduct a habitat assessment of Honey Creek.
3) Conduct a bioassessment of the macroinvertebrate community of Honey Creek.

1.4 Null Hypotheses

1) Habitat will not differ substantially among Honey Creek stream segments.
2) Habitat will not differ between Honey Creek and biocriteria reference streams in the Plains/Grand/Chariton Drainages EDU.
3) Macroinvertebrate assemblages will not differ substantially among Honey Creek stream segments.
4) Macroinvertebrate assemblages will not differ substantially between Honey Creek and biocriteria reference streams in the Plains/Grand/Chariton Drainages EDU.

2.0 Study Area

The classified reaches of Honey Creek begin in northern Grundy County approximately 4.5 miles east of the city of Spickard at the convergence of East Fork Honey Creek and West Fork Honey Creek (SE¼ NE¼ NE¼ S29 T63N R23W). Honey Creek flows south-southwest from this point for 23 miles where it reaches the confluence with the Thompson River (NE¼ NE¼ SE¼ S27 T59N R24W). The entire drainage of Honey Creek is approximately 110 square miles.

2.1 Station Descriptions

Five stations were chosen along Honey Creek. These stations, chosen for accessibility and as representative reaches of stream, average about 5.5 miles apart. See Figure 1 for a map of study stations.

Honey Creek station 1 (SW¼ NW¼ NE¼ S23 T59N R24W) is located downstream of County Road 208 in northern Livingston County, approximately 1.3 miles upstream of the confluence with the Thompson River. The stream is channelized and bounded by levees. Riparian vegetation zone width on the left descending bank is typically good, while riparian vegetation zone width on the right descending bank is typically poor. Stream discharge was measured at 0.59 cubic feet per second (**cfs**) in fall 2005 and 2.76 cfs in spring 2006. Geographic coordinates for this study station are Latitude 39.916600°, Longitude -093.579633°.

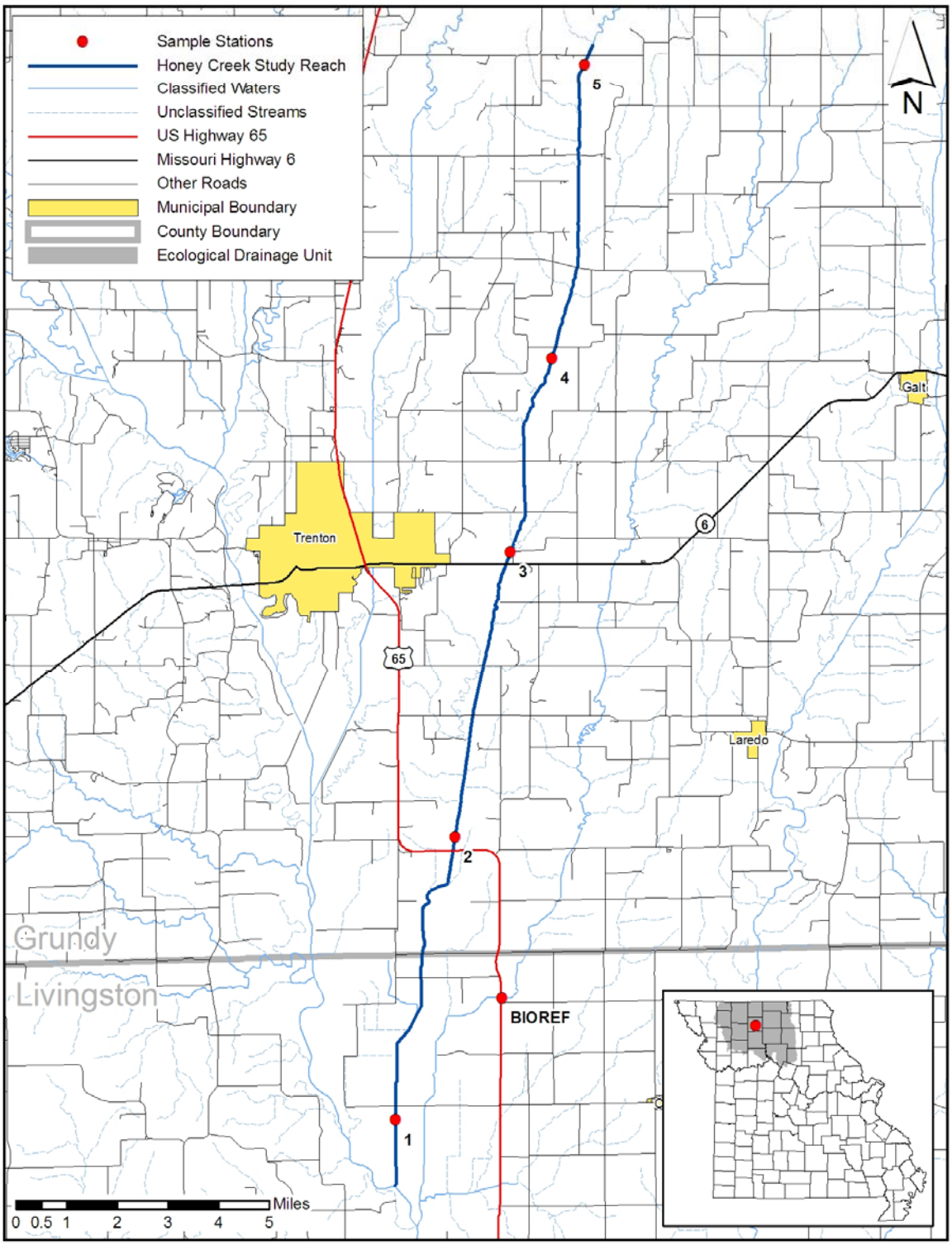
Honey Creek station 2 (SW¼ SW¼ SW¼ S24 T60N R24W) is located upstream of US Highway 65 in southern Grundy County, approximately 6.1 miles upstream of Honey Creek station 1. The stream is channelized. Riparian vegetation zone width on the left descending bank is typically good, while riparian vegetation zone width on the right descending bank is typically poor. Stream discharge was measured at 0.74 cfs in fall 2005 and 2.14 cfs in spring 2006. Geographic coordinates for this study station are Latitude 39.997367°, Longitude -093.558267°.

Honey Creek station 3 (SE¼ SE¼ SE¼ S13 T61N R24W) is located upstream of Missouri Highway 6 in central Grundy County, approximately 5.9 miles upstream of Honey Creek station 2. The stream is channelized. Riparian vegetation zone width on the left descending bank is good to fair, while riparian vegetation zone width on the right descending bank is typically fair. Stream discharge was measured at 0.71 cfs in fall 2005 and 2.65 cfs in spring 2006. Geographic coordinates for this study station are Latitude 40.079167°, Longitude -093.538283°.

Honey Creek station 4 (NW¼ SE¼ SE¼ S30 T62N R23W) is located downstream of Northeast 43rd Street in central Grundy County, approximately 4.2 miles upstream of Honey Creek station 3. The stream is channelized. Riparian vegetation zone width on the left descending bank is typically fair, while riparian vegetation zone width on the right descending bank ranges from good to fair. Stream discharge was measured at 0.49 cfs in fall 2005 and 1.12 cfs in spring 2006. Geographic coordinates for this study station are Latitude 40.134483°, Longitude -093.523150°.

Honey Creek station 5 (NE¼ NE¼ NW¼ S32 T63N R23W) is located downstream of Northeast 100th Street in northern Grundy County, approximately 5.9 miles upstream of Honey Creek station 4. The stream is channelized. Riparian vegetation zone width on the left descending bank and right descending bank is typically fair. Stream discharge was measured at <0.10 cfs in fall 2005 and 0.33 cfs in spring 2006. Geographic coordinates for this study station are Latitude 40.218600°, Longitude -093.511750°.

Figure 1
Study Locations Map with Ecological Drainage Unit Inset



For comparison, a habitat assessment was performed for a station on No Creek, a neighboring wadeable/perennial biocriteria reference stream (**BIOREF**). BIOREF No Creek (SW¼ SW¼ SW¼ S6 T59N R23W) is located upstream of US Highway 65 in northern Livingston County. The stream is not channelized. Riparian vegetation zone width on the left descending bank and right descending bank is typically good. Geographic coordinates for this study station are Latitude 39.951567°, Longitude -093.540517°.

3.0 Methods

Mike Irwin, Carl Wakefield, and other staff of the MDNR, ESP, WQMS conducted this study. Sampling was conducted during the fall of 2005 and the spring of 2006, and samples were collected at sites that provided a variety of habitat characteristics. Fall sampling was conducted on September 26 and 27, 2005, and consisted of macroinvertebrate sampling, water quality sampling, and habitat assessments. This study also included a habitat assessment of No Creek, a wadeable/perennial biocriteria reference streams (**BIOREF**). Spring sampling was conducted on March 22 and 23, 2006, and consisted of macroinvertebrate and water quality sampling.

3.1 Physicochemical Characteristics

Physical and chemical water samples were collected from all Honey Creek stations during both fall and spring. Parameters collected were total nitrogen, nitrate + nitrite as nitrogen, ammonia as nitrogen, total phosphorus, chloride, turbidity, temperature, conductivity, dissolved oxygen, pH, and discharge. WQMS personnel analyzed temperature, conductivity, dissolved oxygen, pH, and discharge in the field and turbidity in the biology laboratory. All other parameters were delivered to the ESP, Chemical Analysis Section for analyses. All samples were collected according to the standard operating procedure MDNR-FSS-001: Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2003a) and were recorded on an MDNR chain-of-custody (MDNR 2005b).

3.2 Habitat

Honey Creek was 303(d) listed for stream habitat degradation through excessive sedimentation. No suspended sediment data exists to directly document sediment as a significant impact to the stream. General fisheries data and the effect of sediment upon fish constituted the original rationale for 303(d) listing Honey Creek. Sedimentation is one of many instream habitat problems associated with land use. Although instream habitat can be directly measured, the causes of the degradation can range from local scale sources to watershed scale sources. We collected habitat measures at the watershed scale, the reach scale, and the habitat scale to better allow us to evaluate the causes of poor habitat conditions.

3.2.1 Land Use

The land use conditions were summarized from land cover GIS files. Percent land cover data were derived from Thematic Mapper (TM) satellite data collected between 2000 and 2004 and interpreted by the Missouri Resource Assessment Partnership (**MoRAP**). USGS aerial photographs taken within the past 10 years were also used to estimate riparian health of the sampling reach.

3.2.2 Habitat Assessment

Standardized assessment procedures were followed as described for glide/pool habitats in the Stream Habitat Assessment Project Procedure (SHAPP) (MDNR 2003c). Habitat assessments were conducted on Honey Creek and BIOREF No Creek during the fall 2005 sample season.

3.2.3 Width to Depth Ratio

At each sampling station a series of 10 bank to bank transects were established. Each transect was equally spaced within the sampling reach, which is 20 times the average width. Measurements taken at each transect included lower bank width (see the Stream Habitat Assessment Project Procedure for a definition of lower bank), wetted width, and water depth at 25%, 50%, and 75% of the distance across the wetted width. In order to document critical habitat conditions, measurements were collected during the fall low flow period.

3.2.4 Sinuosity

Sinuosity was used as an indicator of the amount of channelization that has taken place. Sinuosity was measured using ArcGIS stream coverages, including digital aerial photos, and is represented as a ratio of the actual stream length between two points on the stream to the straight line distance between the two points. Numbers close to 1.0 are considered to be extremely channelized. The target reach length to measure sinuosity was 3200 meters (+/- 200 meters) with the sampling station centered in the middle of the reach.

3.3 Biological Assessment

The biological assessment was conducted according to the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003b). All stations were sampled in September 2005 and March 2006. Three standard habitats of glide/pool streams (e.g. depositional substrate in non-flowing water, large woody debris substrate, and rootmat substrate) were sampled at all locations.

Macroinvertebrate data were evaluated by comparison to Biological Criteria for Perennial/Wadeable streams of the Plains/Grand/Chariton Drainages Ecological Drainage Unit (**EDU**). An EDU is an ecological area in which the aquatic biological communities and stream habitat can be expected to be similar. See the inset in Figure 1 for general stream location and a highlighted Plains/Grand/Chariton Drainage EDU.

Biological criteria are calculated separately for the fall (mid-September through mid-October) and spring (mid-March through mid-April) index periods. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric Macroinvertebrate Stream Condition Index (**MSCI**). The four core metrics of the MSCI are: Taxa Richness (**TR**); Ephemeroptera, Plecoptera, and Trichoptera Taxa (**EPTT**); Biotic Index (**BI**); and the Shannon Diversity Index (**SDI**). An MSCI score of 16-20 is considered as full biological sustainability, 10-14 as partial biological sustainability, and 4-8 as non-biological sustainability. Table 1 provides scoring criteria for the fall index period and Table 2 for the spring index period.

Table 1
Biological Criteria for Glide/Pool-Fall Index Period
Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	<26	26 - 51	>51
EPT	<4	4 - 9	>9
BI	>8.60	8.60 - 7.20	<7.20
SDI	<1.34	1.34 - 2.68	>2.68

Table 2
Biological Criteria for Glide/Pool-Spring Index Period
Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	<26	26 - 51	>51
EPT	<4	4 - 8	>8
BI	>8.62	8.62 - 7.24	<7.24
SDI	<1.26	1.26 - 2.53	>2.53

4.0 Results and Analyses

4.1 Physicochemical Parameters

Physicochemical results from the fall 2005 and spring 2006 sampling seasons can be found in Table 3. Unusual or notable values are in bold text. There were no violations of Missouri water quality standards for any parameters; however, total phosphorus values were elevated in the fall 2005 sampling season. The reason for these elevated values is unknown. Because Honey Creek station 3 is included in Missouri's wadeable stream monitoring network, additional nutrient data are available from this particular station upon request. Other than elevated total phosphorus values, there are no notable results for any physicochemical parameters.

Table 3
Physicochemical Results

Season	Honey Creek Station	Date	Sample Number	Ammonia as N (mg/L)	Chloride (mg/L)	DO (mg/L)	Flow (cfs)	pH (su)	SC (µS/cm)	Temperature (°C)	Turbidity (NTU)	Nitrate + Nitrite as N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
Fall 2005	**1**	09/26/2005	0506601	<0.03	17.5	8.42	0.59	7.89	499	22.0	30.0	<0.01	0.51	**0.48**
	2	09/26/2005	0506602	<0.03	17.2	9.13	0.74	8.18	515	21.8	5.50	<0.01	0.35	**0.34**
	3	09/27/2005	0506603	<0.03	14.0	9.58	0.71	7.44	548	16.2	11.0	<0.01	0.31	**0.32**
	4	09/27/2005	0506604	<0.03	11.7	8.41	0.49	8.17	512	24.6	2.00	<0.01	0.29	**0.33**
	5	09/27/2005	0506605	<0.03	7.9	8.65	0.04	8.17	391	21.6	3.00	<0.01	0.35	**0.32**
Spring 2006	**1**	03/22/2006	0603170	<0.03	16.7	14.1	2.76	8.89	492	5.0	5.08	0.04	0.31	0.07
	2	03/22/2006	0603171	<0.03	17.6	12.2	2.14	7.93	516	10.0	9.65	0.07	0.43	0.05
	3	03/22/2006	0603172	0.06	13.2	12.7	2.65	7.56	526	12.0	7.73	0.09	0.43	0.05
	4	03/23/2006	0603173	<0.03	10.4	13.8	1.12	8.07	508	5.0	7.19	<0.01	0.36	0.02
	5	03/23/2006	0603174	0.04	8.19	12.3	0.33	8.24	466	14.0	9.05	<0.01	0.45	0.02

4.2 Habitat

4.2.1 Land Use

The land use data in Table 4 is provided in two scales. A broad scale comparison is provided by comparing the 14-digit hydrologic unit (**HU**) for Honey Creek stations with the Plains/Grand/Chariton Drainages EDU. A refined scale comparing distinct HUs is provided by comparing the 14-digit HU for Honey Creek stations with the 14-digit HUs of BIOREF streams in the Plains/Grand/Chariton Drainages EDU.

In regards to land use, there is an appreciable difference between Honey Creek HUs. The HU associated with Honey Creek stations 1, 2, and 3 contains considerably more cropland and less grassland and forest than the average for the Plains/Grand/Chariton Drainages EDU. While the percentage of forest changes relatively little, the HU associated with Honey Creek stations 4 and 5 contains considerably less cropland and more grassland than the average for the Plains/Grand/Chariton Drainages EDU.

Comparing land use percentages for HUs associated with Honey Creek and the HUs associated with BIOREF streams within the Plains/Grand/Chariton Drainages EDU provides some insight as well. There are some slight differences in percentage urban land use, but these differences are quite variable. There are some trends associated with land use percentages for crops, grassland, and forest. The HU associated with Honey Creek stations 1, 2, and 3 contained a higher

percentage of crops as well as lower percentages of grassland and forest than eight of the nine BIOREF HUs. The HU associated with Honey Creek stations 4 and 5 contained a higher percentage of crops than six of the nine BIOREF HUs, a lower percentage of grassland than three of nine BIOREF HUs, and a lower percentage of forest than eight of nine BIOREF HUs.

Table 4
Land Use

Station/BIOREF	HU	URBAN	CROPS	GRASS	FOREST
Honey Creek (1, 2, & 3)	10280102180004	2	45	29	13
Honey Creek (4 & 5)	10280102180003	2	22	61	10
Plains/Grand/Chariton EDU	EDU	2	28	45	18
East Fork Grand River	10280101060008	0	22	53	19
Locust Creek	10280103090001	0	13	63	15
Locust Creek	10280103090004	2	10	62	20
Marrowbone Creek	10280101170001	2	21	53	19
No Creek	10280102180005	3	51	33	6
Spring Creek	10280202010002	1	10	28	55
West Fk Big Ck	10280101150003	1	23	49	21
West Locust Ck	10280103090007	1	10	67	15
West Locust Ck	10280103090009	1	11	60	21

4.2.2 Habitat Assessment

Scoring results of the habitat assessment are found in Table 5. Honey Creek station 5 is ranked lowest (73) and station 2 the highest (99). In the SHAPP, $\geq$ 75% similarity is the guidance for considering habitats comparable between stations. Comparable habitats should be able to support comparable biological communities. The SHAPP score similarity between the highest ranked station and the lowest ranked station is 73.7%, just below the threshold of comparability. When comparing Honey Creek stations with the BIOREF No Creek station, comparability ranges from 62.4% to 84.6%. The BIOREF No Creek station is only comparable to two of the five Honey Creek stations.

Table 5
Habitat Assessment Scores

Station	SHAPP Score	% of Reference
Honey Creek 1	78	**66.7**
Honey Creek 2	99	84.6
Honey Creek 3	88	75.2
Honey Creek 4	86	**73.5**
Honey Creek 5	73	**62.4**
BIOREF No Creek	117	100.0

4.2.3 Width to Depth Ratios

Station transect measurements for lower bank channel width, wetted width, and depth are provided in Appendix A. A summary of stream width and depth measurement data is available in Table 6.

Table 6
Stream Width and Depth Measurement Summary

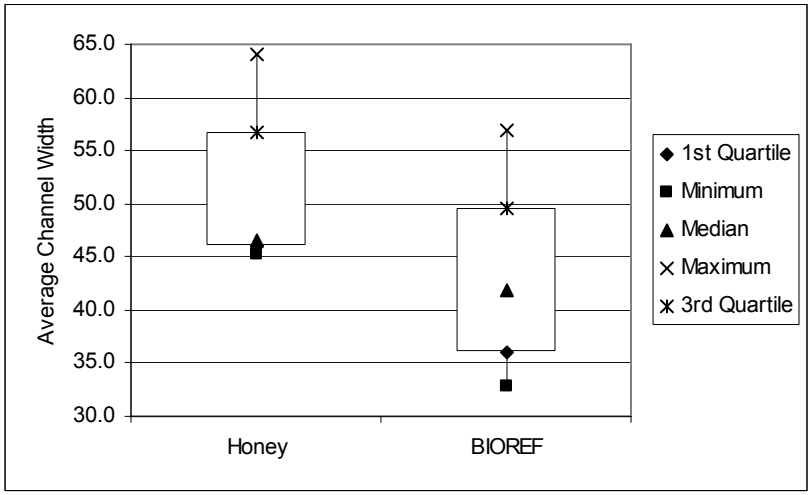
Station/BIOREF	Average Channel Width (ft)	Average Wetted Width (ft)	Channel Width/ Wetted Width	Average Depth (ft)	Maximum Depth (ft)	Depth Standard Deviation	Wetted Width/ Depth	Watershed Area (sq mi)	Sinuosity (mi/mi)
Honey Creek 1	56.7	24.5	2.31	0.3	0.7	0.18	91.30	123	1.00
Honey Creek 2	46.0	17.4	2.65	0.3	0.8	0.21	66.52	112	1.07
Honey Creek 3	64.0	15.8	4.06	0.4	1.2	0.35	40.91	82	1.04
Honey Creek 4	46.6	16.7	2.80	0.2	0.5	0.10	96.64	71	1.02
Honey Creek 5	45.3	15.9	2.85	0.2	0.5	0.10	76.27	53	1.15
East Fork Grand River	57.0	40.3	1.41	0.7	2.0	0.49	57.96	228	1.48
Locust Creek	36.5	26.6	1.37	1.1	2.8	0.60	24.88	64	1.04
Marrowbone Creek	56.9	33.5	1.70	1.0	2.7	0.56	34.06	66	1.58
No Creek	32.8	19.6	1.67	1.1	4.3	1.19	17.60	64	1.24
Spring Creek	47.2	25.1	1.88	0.8	2.9	0.74	33.14	84	1.26
West Fork Big Creek	34.9	22.5	1.55	0.9	2.2	0.50	24.99	91	1.73
West Locust Creek 1	40.8	23.3	1.75	1.4	3.7	1.18	16.54	88	1.43
West Locust Creek 2	42.8	26.7	1.60	1.1	3.3	0.90	25.16	82	2.33

Some general trends are relatively obvious in Table 6, such as the differences between Honey Creek and BIOREF stations for average wetted widths, average depths, maximum depths, and the standard deviations of average depths. In order to do comparisons of stream stations, however, it is sometimes necessary to incorporate ratios of measurements. Ratios can standardize measurements so that data such as channel width can be used in a manner that allows comparison of study stations regardless of their longitudinal placement or relation to watershed size. For this reason, the ratios of average channel width/average wetted width and average wetted width/average depth are also given in Table 6.

To further demonstrate differences and general trends between Honey Creek and BIOREF stations, box plots were generated for some of the parameters in Table 6. Minimums, first quartiles, medians, third quartiles, and maximums were generated for two primary groupings, Honey Creek and BIOREF stations. Each of these plots will be discussed independently.

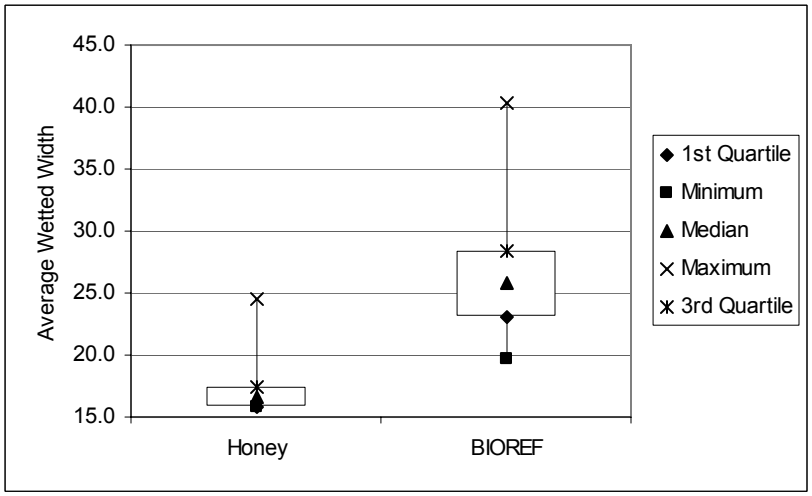
As shown in Figure 2, the channel widths of Honey Creek stations are typically wider than those of BIOREF stations, but the median values for Honey Creek stations fall between the first and third quartiles for BIOREF stations. While there are some differences in average channel width between Honey Creek and BIOREF stations, these differences are not outstanding.

Figure 2
Average Channel Width



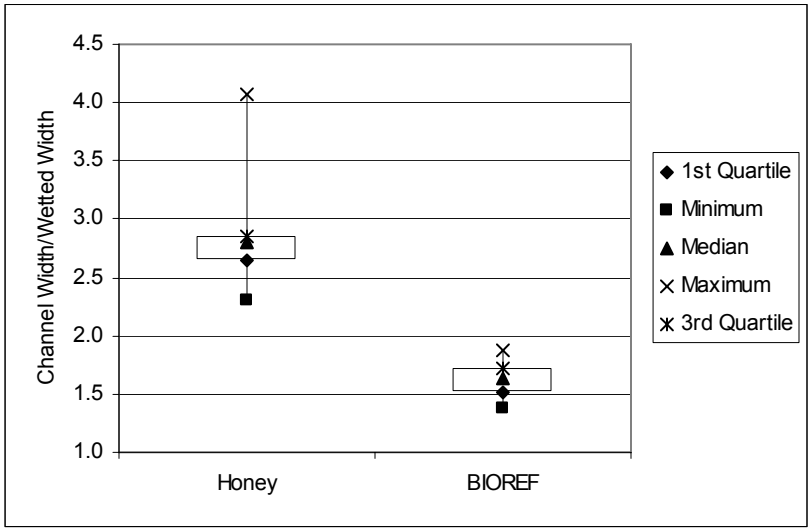
As shown in Figure 3, the wetted widths of BIOREF stations are typically wider than those of Honey Creek stations. The median average channel width value for BIOREF stations was greater than the maximum for Honey Creek stations.

Figure 3
Average Wetted Width



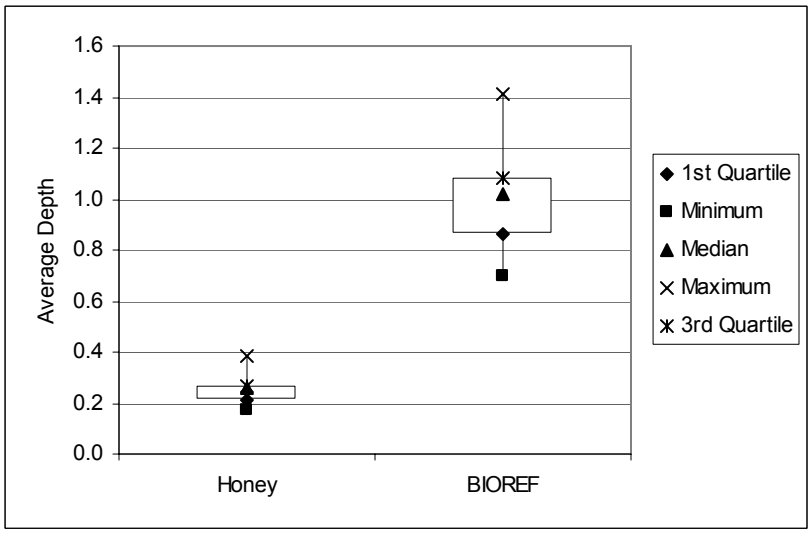
The average channel width to average wetted width ratio can provide additional insight. As shown in Figure 4, the average channel width to average wetted width ratios of Honey Creek stations are typically much larger than those of BIOREF stations. In fact, the minimum value for Honey Creek stations is greater than the maximum for BIOREF stations. In other words, a larger portion of the channel is filled with water at BIOREF stations than at Honey Creek stations.

Figure 4
Average Channel Width to Average Wetted Width



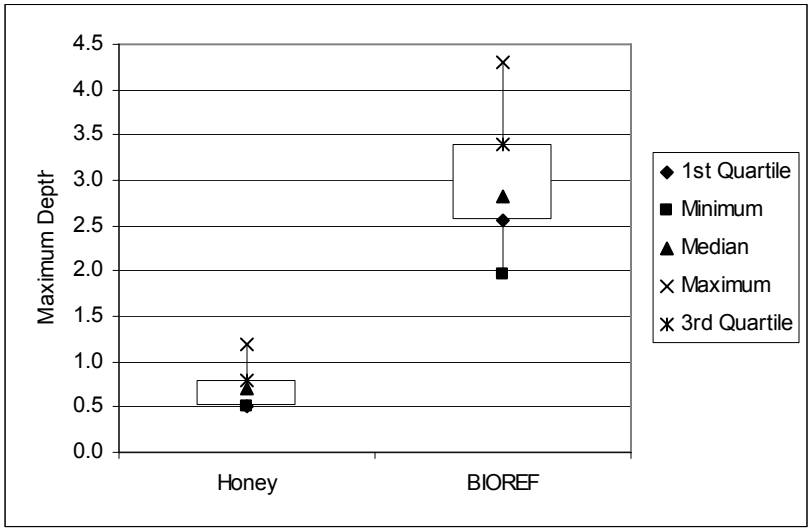
As shown in Figure 5, the average depths of BIOREF stations are greater than those of Honey Creek stations. The minimum value for average depth for BIOREF stations was notably greater than the maximum value for Honey Creek stations.

Figure 5
Average Depth



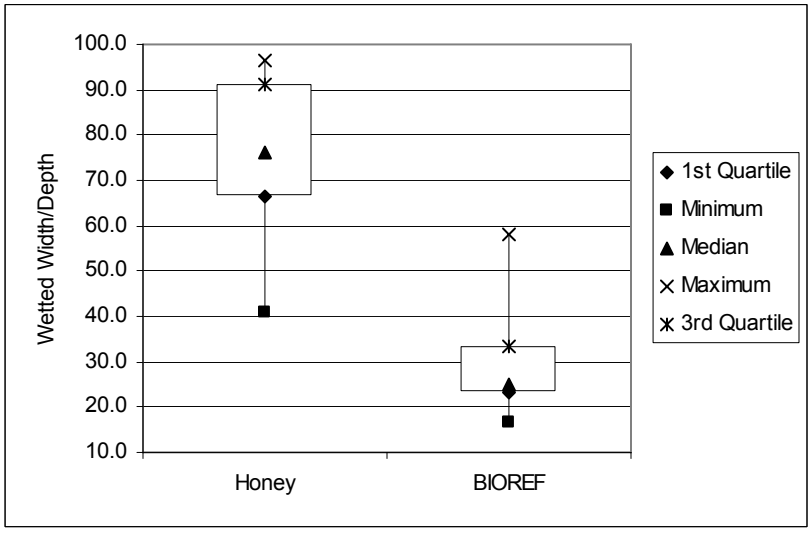
As shown in Figure 6, the maximum depths of BIOREF stations are typically much greater than those of Honey Creek stations. Similar to average depths, the minimum value for maximum depth for BIOREF stations was notably greater than the maximum value for Honey Creek stations.

Figure 6
Maximum Depth



Calculating a ratio using average wetted width and average depth measurements provides additional insight in the potential wide shallow nature of Northern Missouri channelized streams. As shown in Figure 7, the average wetted width to average depth ratios of Honey Creek stations are typically much larger than those of BIOREF stations. In fact, the first quartile value for Honey Creek stations is greater than the maximum for BIOREF stations. In other words, Honey Creek stations exhibit greater wide/shallow characteristics than BIOREF stations.

Figure 7
Average Wetted Width to Average Depth

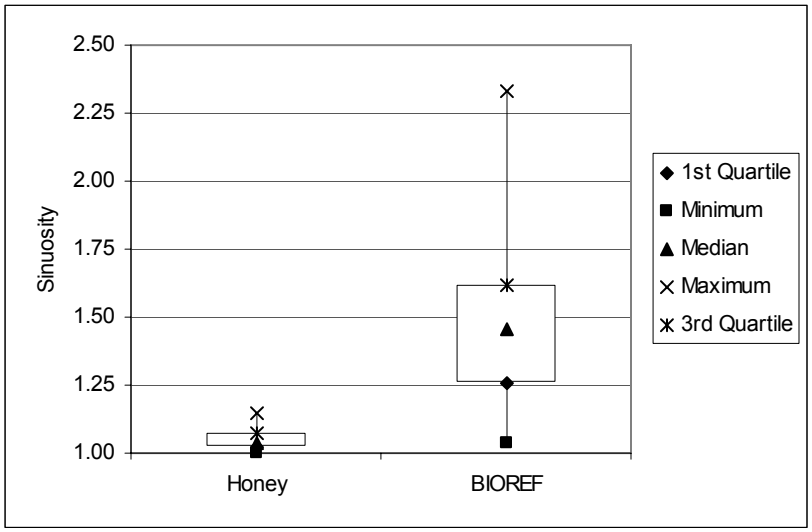


To summarize, Honey Creek stations appear to have wider channels with narrower wetted widths and are shallower than BIOREF stations.

4.2.4 Sinuosity

The sinuosity index values for Honey Creek and BIOREF stations are listed in Table 6. With a sinuosity index value of 1.00, Honey Creek station 1 is the most channelized station in the study reach. Honey Creek station 5, with a sinuosity index value of 1.15, is the least channelized. Only one sinuosity index value from the BIOREF stations, BIOREF Locust Creek at 1.04, was within the range of Honey Creek sinuosity index values. Like the width and depth characteristics of this study, a box plot (Figure 8) was generated from sinuosity index values to further demonstrate differences and general trends between Honey Creek and BIOREF stations. Compared to nearly all of the BIOREF stations, Honey Creek stations appear to have undergone a much greater degree of historic channelization.

Figure 8
Sinuosity



4.3 Biological Assessment

The Honey Creek metric results and MSCI scores for fall 2005 and spring 2006 are found in Tables 7 and 8 respectively. MSCI scores are calculated by scoring study station metrics against the appropriate criteria in Table 1 or Table 2.

In fall 2005 samples, the BI score for Honey Creek station 5 and the SDI scores for Honey Creek stations 1, 2, and 5 resulted in lower than optimum MSCI scores. In spring 2006, the TR score for Honey Creek station 4, the BI scores for Honey Creek stations 3 and 5, and the SDI score for Honey Creek station 5 resulted in lower than optimum MSCI scores. However, MSCI scores for all Honey Creek stations and both seasons were $\geq$ 16, resulting in an assignment of full biological sustainability.

Summaries regarding macroinvertebrate community structure for each Honey Creek station are available in Tables 9 and 10.

Table 7
Fall 2005 Macroinvertebrate Stream Condition Index Scores

Station	Honey Creek 1	Honey Creek 2	Honey Creek 3	Honey Creek 4	Honey Creek 5
Sample Number	0506201	0506202	0506203	0506204	0506205
TR - Metric (Score)	57 (5)	61 (5)	77 (5)	73 (5)	66 (5)
EPT - Metric (Score)	15 (5)	12 (5)	16 (5)	15 (5)	12 (5)
BI - Metric (Score)	5.99 (5)	6.54 (5)	6.50 (5)	6.31 (5)	7.22 (3)
SDI - Metric (Score)	2.55 (3)	2.39 (3)	3.03 (5)	3.02 (5)	2.25 (3)
MSCI Score	18	18	20	20	16
Sustainability	FULL	FULL	FULL	FULL	FULL

Table 8
Spring 2006 Macroinvertebrate Stream Condition Index Scores

Station	Honey Creek 1	Honey Creek 2	Honey Creek 3	Honey Creek 4	Honey Creek 5
Sample Number	0602621	0602622	0602623	0602624	0602625
TR - Metric (Score)	71 (5)	60 (5)	67 (5)	50 (3)	67 (5)
EPT - Metric (Score)	14 (5)	12 (5)	12 (5)	9 (5)	10 (5)
BI - Metric (Score)	7.08 (5)	6.97 (5)	7.24 (3)	7.23 (5)	7.47 (3)
SDI - Metric (Score)	2.88 (5)	2.92 (5)	2.67 (5)	2.61 (5)	2.46 (3)
MSCI Score	20	20	18	18	16
Sustainability	FULL	FULL	FULL	FULL	FULL

Table 9
Fall 2005 Macroinvertebrate Summary

Station	1	2	3	4	5
Taxa Richness	57	61	77	73	66
Number EPT Taxa	15	12	16	15	12
% Ephemeroptera	61.7	57.7	34.1	38.4	61.0
% Plecoptera	0.0	0.0	0.0	0.0	0.0
% Trichoptera	8.4	10.3	6.9	6.1	2.1
Total EPT %	70.1	68.0	41.0	44.5	63.1
% Diptera	24.7	19.7	47.0	42.8	19.2
% Dominant Families					
Caenidae	36.7	43.3	21.5	22.8	54.1
Chironomidae	21.0	19.0	45.1	39.1	18.2
Leptophlebiidae	18.1	8.6	7.4	11.9	3.0
Leptoceridae	8.0	10.2	4.1		
Heptageniidae	3.7				
Coenagrionidae		4.0	3.1		
Hydropsychidae				3.5	
Calopterygidae				3.3	
Physidae					5.0
Sphaeriidae					3.6

In fall 2005, Caenidae was the most dominant macroinvertebrate family for Honey Creek stations 1, 2, and 5. Chironomidae was the dominant family for Honey Creek stations 3 and 4. Trichoptera were found at all Honey Creek stations in each season, but no Plecoptera were found at any of the stations in any season.

Table 10
Spring 2006 Macroinvertebrate Summary

Station	1	2	3	4	5
Taxa Richness	71	60	67	50	67
Number EPT Taxa	14	12	12	9	10
% Ephemeroptera	44.0	33.1	31.1	37.3	37.2
% Plecoptera	0.0	0.0	2.0	0.0	0.0
% Trichoptera	4.4	2.5	1.5	1.4	0.4
Total EPT %	48.4	35.6	34.6	38.7	37.6
% Diptera	46.4	58.8	62.0	55.7	55.2
% Dominant Families					
Chironomidae	44.7	52.2	59.0	53.4	52.1
Caenidae	32.5	25.0	25.6	29.6	34.7
Leptophlebiidae	7.1	5.3	2.1	4.4	1.7
Leptoceridae	4.2				
Heptageniidae	3.0				
Ceratopogonidae		2.9			2.5
Simuliidae		2.6			
Baetidae			1.8	2.7	
Hyalellidae			1.4	2.5	
Physidae					1.9

In spring 2006, results were very similar. Caenidae was the most dominant macroinvertebrate family for Honey Creek stations 1, 2, and 5. Chironomidae was the dominant family for Honey Creek stations 3 and 4. Trichoptera were found at all Honey Creek stations in each season, but no Plecoptera were found at any of the stations in any season.

5.0 Discussion

The Missouri Water Quality Standards numeric criteria were not violated in any of the Honey Creek water samples. While the list of physicochemical parameters is not exhaustive, no inference can be made from these data that the Honey Creek study reach is impaired for physicochemical reasons. There are, however, some habitat inferences that can be made from land use, SHAPP scores, width and depth measurements, and sinuosity.

Regarding land use, Honey Creek stations 1, 2, and 3 appear to trend more toward row crop agricultural than Honey Creek stations 4 and 5, the Plains/Grand/Chariton Drainages EDU, and most of the BIOREF streams within the Plains/Grand/Chariton Drainages EDU. Honey Creek

stations 1, 2, and 3 contain a much higher amount of cropland and a much lower amount of grassland.

Honey Creek SHAPP scores were relatively low and variable within the Honey Creek study reach. Honey Creek stations 2 and 3 were the only stations comparable to the BIOREF No Creek, and Honey Creek station 2 barely exceeded the guidance limit for comparability. In addition the lowest ranked Honey Creek station 5 did not meet the guidance limit for comparability to the highest ranked Honey Creek station 2.

When width and depth data are compared between Honey Creek stations and BIOREF stations within the Plains/Grand/Chariton Drainages EDU, results suggest that Honey Creek is a comparatively wide/shallow stream with few pools. Some of these differences are very pronounced when analyzed in greater detail. Lack of instream habitat can be observed in Northern Missouri streams that are wide and shallow. Wider, shallower streams tend to have less ability to develop pools and retain woody debris (Haithcoat et al. 2003).

Channelization generally causes steeper stream gradients and overall reduction of pool depth (EPA 2006). When compared against BIOREF stations within the Plains/Grand/Chariton Drainages EDU, sinuosity index values indicate that Honey Creek is quite channelized. Only one of the eight BIOREF stream stations fell within the range of Honey Creek sinuosity indices.

While all of these habitat issues are indicated, they do not appear to have significant effect on the macroinvertebrate community of Honey Creek. Although invertebrates are responsive to changes in substrate they may not be responsive to habitat problems such as lack of pools. The lack of top predator fish has been shown to have good relationship to channelized streams and the resulting lack of pools (MDNR 2005a). Fish surveys may provide more valuable insight than invertebrates regarding habitat problems in extensively channelized streams.

6.0 Conclusions

Four null hypotheses were stated in the introduction: 1) Habitat will not differ substantially among Honey Creek stream segments; 2) Habitat will not differ between Honey Creek and biocriteria reference streams in the Plains/Grand/Chariton Drainages EDU; 3) Macroinvertebrate assemblages will not differ substantially among Honey Creek stream segments; 4) Macroinvertebrate assemblages will not differ substantially between Honey Creek and biocriteria reference streams in the Plains/Grand/Chariton Drainages EDU.

Null hypothesis #1 is rejected. Land use and SHAPP scores revealed that the habitat of Honey Creek stations were not comparable.

Null hypothesis #2 is rejected. Land use, SHAPP scores, width and depth analyses, and sinuosity index values revealed that the habitat of Honey Creek stations was not comparable to BIOREF stream stations within the Plains/Grand/Chariton Drainages EDU.

Null hypothesis #3 is accepted. The macroinvertebrate community of all Honey Creek stations in both seasons exhibited similar dominant taxa and received similar MSCI scores.

Null hypothesis #4 is accepted. The macroinvertebrate community of all Honey Creek stations in both seasons did not substantially differ from the MSCI, which is calculated from biocriteria reference streams within the same EDU.

Even though multiple measures suggest habitat degradation, the overall bioassessment for the Honey Creek segment covered by this study suggests no biological impairment due to water quality or substrate. Exactly 100% of the MSCI scores are $\geq$ 16 (full biological sustainability). During the development of biological criteria (MDNR 2002a) it was demonstrated that individual wadeable perennial reference streams stations scored $\geq$ 16 about 86% of the time.

7.0 Recommendations

1) Propose Honey Creek for de-listing from the 303(d) list for sediment impairment.
2) Recognize the need for development and incorporation of satisfactory fish bioassessment protocols into the department's aquatic bioassessment program.
3) Conduct fish bioassessments of extensively channelized streams to further evaluate the relationship between the protection of aquatic life designated use, habitat conditions, pool depths, and stream channel characteristics.

8.0 Literature Cited

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APPENDIX A
Fall 2005
Width and Depth Data

Honey Creek Station 1					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % of Wetted Width (ft)		
			25%	50%	75%
1	55.5	23.0	0.40	0.20	0.05
2	56.0	11.0	0.25	0.25	0.25
3	56.0	28.0	0.30	0.15	0.20
4	61.0	16.0	0.30	0.25	0.35
5	53.0	30.0	0.05	0.05	0.20
6	58.0	18.0	0.25	0.05	0.10
7	52.0	47.5	0.70	0.05	0.10
8	58.0	21.0	0.20	0.20	0.30
9	59.0	32.0	0.25	0.40	0.55
10	58.0	18.5	0.60	0.60	0.45
Average	56.65	25	0.33	0.22	0.26

Honey Creek Station 2					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % of Wetted Width (ft)		
			25%	50%	75%
1	53.0	11	0.05	0.05	0.15
2	57.0	13	0.10	0.10	0.20
3	43.0	22	0.13	0.15	0.10
4	29.0	27	0.45	0.60	0.50
5	42.0	17	0.55	0.80	0.40
6	43.0	20	0.05	0.35	0.15
7	58.0	21	0.20	0.05	0.25
8	38.0	13	0.05	0.20	0.15
9	48.0	8	0.20	0.20	0.15
10	49.0	23	0.50	0.70	0.30
Average	46	17	0.23	0.32	0.24

Honey Creek Station 3					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % of Wetted Width (ft)		
			25%	50%	75%
1	57.0	16.0	0.15	0.13	0.05
2	46.0	13.5	0.90	0.90	0.70
3	63.0	14.0	0.30	0.40	0.50
4	75.0	13.5	0.17	0.15	0.15
5	57.0	26.0	1.10	0.90	0.95
6	63.0	19.5	0.30	0.60	1.20
7	67.0	17.0	0.20	0.15	0.30
8	70.0	11.0	0.20	0.25	0.15
9	66.0	13.0	0.20	0.20	0.05
10	76.0	14.0	0.15	0.10	0.05
Average	64	16	0.37	0.38	0.41

Honey Creek Station 4					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % of Wetted Width (ft)		
			25%	50%	75%
1	42.0	17.5	0.15	0.05	0.20
2	29.0	24.5	0.15	0.30	0.05
3	30.0	10.5	0.05	0.20	0.25
4	40.0	10.0	0.30	0.10	0.10
5	27.0	24.0	0.05	0.20	0.10
6	53.0	15.7	0.22	0.17	0.17
7	59.0	16.5	0.13	0.15	0.08
8	61.0	26.0	0.10	0.25	0.25
9	60.0	13.0	0.30	0.15	0.10
10	65.0	9.0	0.50	0.20	0.15
Average	46.6	17	0.20	0.18	0.15

Honey Creek Station 5					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % of Wetted Width (ft)		
			25%	50%	75%
1	42.0	18.2	0.10	0.12	0.10
2	45.0	17.0	0.20	0.30	0.40
3	42.0	35.0	0.10	0.20	0.15
4	41.0	17.0	0.50	0.25	0.05
5	49.0	18.0	0.17	0.15	0.10
6	53.0	17.5	0.10	0.20	0.30
7	45.0	9.5	0.20	0.25	0.25
8	47.0	10.0	0.30	0.20	0.10
9	46.0	12.0	0.35	0.20	0.20
10	43.0	4.5	0.15	0.25	0.30
Average	45.3	16	0.22	0.21	0.20

BIOREF No Creek					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % of Wetted Width (ft)		
			25%	50%	75%
1	33.0	13.5	0.10	0.15	0.10
2	36.0	6.5	1.35	1.10	0.55
3	26.5	19.0	0.75	0.40	0.20
4	33.5	23.5	0.50	0.65	0.40
5	32.0	27.0	2.30	4.30	4.30
6	37.0	30.0	1.25	2.50	1.65
7	28.0	23.0	0.60	1.15	0.40
8	34.5	26.5	2.30	2.90	2.10
9	38.0	16.0	0.10	0.10	0.10
10	29.0	11.0	0.30	0.50	0.30
Average	32.75	20	0.96	1.38	1.01

APPENDIX B
Fall 2005
Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506201], Station #1, Sample Date: 9/26/2005 12:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	2		2
AMPHIPODA			
Hyalella azteca		2	2
COLEOPTERA			
Peltodytes			1
Scirtidae	1	3	10
DECAPODA			
Palaemonetes kadiakensis		1	
DIPTERA			
Ablabesmyia	7		2
Anopheles		3	
Ceratopogoninae	4		1
Chironomus		1	19
Cricotopus bicinctus			1
Cryptochironomus	1		1
Dicrotendipes	14	1	27
Forcipomyiinae			24
Glyptotendipes			5
Goeldichironomus			6
Hemerodromia			1
Kiefferulus		1	2
Labrundinia	2	3	5
Parachironomus		2	3
Paracladopelma	1		
Paratanytarsus			1
Paratendipes			1
Phaenopsectra		1	
Polypedilum illinoense grp	2	1	2
Procladius	5		1
Pseudochironomus			2
Psychoda			2
Stempellinella	7		1
Stenochironomus			6
Tanytarsus	16	1	15
Thienemannimyia grp.	1	4	24
EPHEMEROPTERA			
Acerpenna		1	13
Baetidae	1		

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506201], Station #1, Sample Date: 9/26/2005 12:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Baetiscidae			1
Caenis hilaris	5	1	
Caenis latipennis	133	53	149
Heptagenia	1		
Heptageniidae	7	2	
Hexagenia limbata	6		1
Leptophlebiidae	10	152	6
Procloeon	4		2
Stenacron	3		6
Stenonema terminatum	14		2
HEMIPTERA			
Belostoma	-99	-99	
Corixidae			2
Neoplea		1	
Rheumatobates			1
LIMNOPHILA			
Physella	1		
ODONATA			
Argia	3	5	
Boyeria		-99	
Enallagma		6	
Gomphus	1	1	
Macromia		-99	
TRICHOPTERA			
Hydroptila			3
Nectopsyche	12	52	
Oecetis	6	5	
VENEROIDEA			
Sphaeriidae		1	1

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506202], Station #2, Sample Date: 9/26/2005 2:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina			2
AMPHIPODA			
Hyalella azteca	1	9	3
COLEOPTERA			
Berosus		9	2
Dubiraphia		3	
Helichus lithophilus		9	10
Hydroporus		1	
Laccophilus		1	
Scirtidae		2	
Tropisternus		1	
DECAPODA			
Palaemonetes kadiakensis			1
DIPTERA			
Ablabesmyia	12	6	3
Anopheles	1		
Ceratopogoninae	1	3	
Chironomus	1	1	
Cladotanytarsus	1		
Cricotopus bicinctus	1		
Cricotopus/Orthocladius	3		
Cryptochironomus	4		
Dicrotendipes	13	8	19
Forcipomyiinae			1
Gonomyia	1		
Labrundinia	3	4	
Nanocladius	1		
Polypedilum convictum grp		2	
Polypedilum fallax grp		1	
Polypedilum halterale grp	1		
Polypedilum illinoense grp	1	2	1
Procladius		1	
Stempellinella	5	1	
Stenochironomus			1
Tanytarsus	23	9	6
Thienemanniella		1	1
Thienemannimyia grp.	1	31	8
Tribelos		1	1

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506202], Station #2, Sample Date: 9/26/2005 2:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
EPHEMEROPTERA			
Caenis latipennis	200	132	73
Callibaetis	1		
Hexagenia	9	1	1
Leptophlebiidae		47	34
Paracloeodes	3	1	
Procloeon	2		
Stenacron	1	1	23
Stenonema femoratum	2	1	7
Tricorythodes		1	
HEMIPTERA			
Belostoma		-99	
Corixidae	3	1	
Pelocoris		1	
LIMNOPHILA			
Physella		1	8
ODONATA			
Aeshna		-99	
Argia		20	14
Enallagma		3	1
Erythemis		-99	
Gomphus	1	1	
Hetaerina		1	
Libellulidae	1	1	
Macromia	-99		
Progomphus obscurus	1		
TRICHOPTERA			
Hydroptila			1
Nectopsyche	12	77	3
Oecetis	3	1	
UNIONIDA			
Unionidae		1	
VENEROIDEA			
Sphaeriidae		1	

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506203], Station #3, Sample Date: 9/27/2005 8:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		4	5
COLEOPTERA			
Berosus		1	1
Dubiraphia	1		
Helichus lithophilus		2	4
Hydroporus	1		
Macronychus glabratus			1
Scirtidae		14	13
Tropisternus		1	
DIPTERA			
Ablabesmyia	13	1	3
Anopheles		1	1
Ceratopogoninae	7		
Chironomus	4		
Cladotanytarsus	1	3	
Corynoneura		4	
Cricotopus bicinctus		1	5
Cryptochironomus	1	1	
Cryptotendipes		1	
Dicrotendipes	59	10	91
Forcipomyiinae			1
Glyptotendipes			1
Gonomyia			5
Hemerodromia		1	2
Labrundinia	7	7	9
Larsia		1	
Limonia			1
Microtendipes	1		
Nanocladius	1		
Paracladopelma	1		
Paratendipes	2		
Phaenopsectra	1		
Polypedilum convictum grp		1	1
Polypedilum halterale grp	9		
Polypedilum illinoense grp		1	
Polypedilum scalaenum grp	6		3
Procladius	2		
Rheotanytarsus		13	12

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506203], Station #3, Sample Date: 9/27/2005 8:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Stelechomyia			2
Stempellinella	29	6	2
Stenochironomus		2	21
Tanytarsus	51	16	17
Thienemanniella		1	
Thienemannimyia grp.		21	39
undescribed Empididae		1	
EPHEMEROPTERA			
Acerpenna		1	1
Caenis latipennis	187	21	23
Callibaetis	3		
Hexagenia limbata	1		
Isonychia			3
Leptophlebiidae		57	23
Paracloeodes		2	3
Procloeon	1	1	
Stenacron	2	4	11
Stenonema femoratum			1
Stenonema terminatum			16
Tricorythodes		3	2
HEMIPTERA			
Belostoma		-99	
Neoplea		1	
Rheumatobates		1	
LIMNOPHILA			
Lymnaeidae			3
Physella	2	3	3
ODONATA			
Argia	1	18	13
Boyeria		-99	
Calopteryx		1	
Enallagma		2	
Gomphus	1	-99	
Hetaerina		12	1
Macromia		-99	
Progomphus obscurus	1	-99	
TRICHOPTERA			
Cheumatopsyche		7	15
Hydropsyche			4
Hydroptila			3

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506203], Station #3, Sample Date: 9/27/2005 8:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Nectopsyche	16	26	3
TUBIFICIDA			
Aulodrilus		1	
Enchytraeidae	1		
Tubificidae		4	1
UNIONIDA			
Unionidae		-99	
VENEROIDEA			
Sphaeriidae	-99	10	

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506204], Station #4, Sample Date: 9/27/2005 11:55:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	1		
AMPHIPODA			
Hyalella azteca	6	20	2
COLEOPTERA			
Berosus		1	
Helichus lithophilus		3	2
Hydroporus	1		
Scirtidae	1	14	4
DIPTERA			
Ablabesmyia	20	8	1
Anopheles	2		
Ceratopogoninae	4		4
Chironomus	15		
Chrysops	3	1	
Cladotanytarsus	1		1
Corynoneura		1	
Cricotopus bicinctus	3	5	32
Cricotopus/Orthocladius			1
Dicrotendipes	13	3	8
Ephydridae		1	
Forcipomyiinae		1	8
Gonomyia	6		
Hemerodromia		4	14
Labrundinia	2	12	4
Limonia			1
Nilothauma			1
Paralauterborniella	1		
Paratanytarsus		1	
Phaenopsectra		1	1
Polypedilum convictum grp		3	2
Polypedilum illinoense grp	1	15	1
Polypedilum scalaenum grp			1
Procladius	8	2	
Pseudochironomus			1
Rheotanytarsus	1	31	30
Saetheria		1	1
Stempellinella	23	1	
Stenochironomus			24

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506204], Station #4, Sample Date: 9/27/2005 11:55:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Tanytarsus	54	63	32
Thienemannimyia grp.	1	59	34
Tipula	1		
Tribelos			1
Zavrelimyia		2	
EPHEMEROPTERA			
Acerpenna		1	8
Caenis latipennis	206	91	10
Callibaetis	3		
Hexagenia limbata		2	
Leptophlebiidae	12	146	3
Paracloeodes	10	1	6
Pseudocentroptiloides		1	
Stenacron	1	3	3
Stenonema terminatum		1	8
Tricorythodes			2
HEMIPTERA			
Belostoma		-99	
Mesovelia		1	2
Microvelia		1	
Rheumatobates	1		
LIMNOPHILA			
Physella	9	18	-99
ODONATA			
Argia	4	19	1
Basiaeschna janata		-99	
Calopteryx		3	
Enallagma	2	3	
Erythemis		-99	
Gomphus	2	1	1
Hetaerina		40	2
Libellula	1		
Macromia	-99		
Progomphus obscurus	1	-99	
TRICHOPTERA			
Cheumatopsyche	1	15	22
Hydropsyche		1	9
Hydroptila			1
Nectopsyche	8	24	1
Oxyethira	1		

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506204], Station #4, Sample Date: 9/27/2005 11:55:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
TUBIFICIDA			
Aulodrilus		2	
Tubificidae	1	1	
VENEROIDEA			
Sphaeriidae		-99	

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506205], Station #5, Sample Date: 9/27/2005 3:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		2	1
COLEOPTERA			
Berosus			1
Dubiraphia	2	2	
Enochrus			1
Helichus lithophilus		1	
Scirtidae	1	21	6
DECAPODA			
Orconectes virilis	-99		
DIPTERA			
Ablabesmyia	2	2	2
Anopheles		2	
Ceratopogoninae	4		
Chironomus	5	1	1
Cladotanytarsus	2		1
Corynoneura	1	1	
Dicrotendipes	13	3	35
Diptera	1		
Forcipomyiinae			1
Glyptotendipes	1	4	4
Labrundinia	2	5	2
Nanocladius			1
Paraphaenocladius	1		
Paratanytarsus		2	
Phaenopsectra	2		
Polypedilum		2	
Polypedilum convictum grp		1	
Polypedilum fallax grp		1	
Polypedilum halterale grp	2		
Polypedilum illinoense grp	5	4	3
Polypedilum scalaenum grp			1
Procladius	3	2	4
Rheotanytarsus	2		5
Stempellinella	2	5	3
Stenochironomus			19
Stictochironomus			1
Tabanidae		2	
Tanytarsus	4	7	11

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0506205], Station #5, Sample Date: 9/27/2005 3:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Thienemanniella			1
Thienemannimyia grp.	1	2	8
Tribelos			1
undescribed Empididae		1	
EPHEMEROPTERA			
Caenis latipennis	358	65	151
Hexagenia limbata	14		3
Leptophlebiidae	5	25	2
Paracloeodes	1		7
Procloeon			1
Pseudocloeon		1	
Stenacron			8
Stenonema femoratum	1	1	2
Tricorythodes		1	1
HEMIPTERA			
Belostoma	-99	-99	
Corixidae	2	2	
Mesovelia	1		
Microvelia		7	1
LIMNOPHILA			
Physella	16	30	7
ODONATA			
Argia	2	11	5
Boyeria		1	
Calopteryx	-99	-99	1
Enallagma		12	1
Gomphus	2	-99	
Hetaerina	-99	1	
Macromia	-99	-99	
Progomphus obscurus	2	-99	
TRICHOPTERA			
Cheumatopsyche			2
Nectopsyche	3	15	2
Oecetis	1		
TUBIFICIDA			
Tubificidae	2	1	2
VENEROIDEA			
Sphaeriidae	1	37	1

APPENDIX C
Spring 2006
Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602621], Station #1, Sample Date: 3/22/2006 10:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina		1	
AMPHIPODA			
Crangonyx		3	
Hyalella azteca	3	6	1
COLEOPTERA			
Dineutus		-99	1
Helichus lithophilus		4	4
Neoporus	1		
Paracymus			1
Peltodytes		1	
Scirtidae			2
DECAPODA			
Palaemonetes kadiakensis		-99	
DIPTERA			
Ablabesmyia	12	14	1
Ceratopogoninae	9		
Chironomus	3		
Chrysops		-99	
Cladotanytarsus	2		
Corynoneura	6	3	4
Cricotopus bicinctus	26	29	3
Cricotopus/Orthocladius	9	4	6
Cryptochironomus	2		
Dicrotendipes	32	7	7
Dolichopodidae		1	
Gonomyia	1		
Hydrobaenus	5	4	16
Labrundinia	2	8	
Nanocladius		13	
Parakiefferiella			1
Paraphaenocladius	2	3	3
Paratanytarsus		5	
Phaenopsectra		5	1
Polypedilum convictum grp	1	2	1
Polypedilum halterale grp	3		
Polypedilum illinoense grp	4	4	2
Polypedilum scalaenum grp	3		
Procladius	1		

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602621], Station #1, Sample Date: 3/22/2006 10:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Pseudochironomus	1		
Rheotanytarsus	8	14	1
Saetheria	54		
Simulium			5
Stempellinella	1		
Tanytarsus	44	18	2
Thienemanniella	3	5	1
Thienemannimyia grp.	3	21	7
EPHEMEROPTERA			
Acerpenna	1	7	2
Caenis latipennis	118	123	80
Heptagenia	1	3	5
Hexagenia	1		
Leptophlebia	6	11	54
Stenacron	3		9
Stenonema femoratum	1	-99	1
Stenonema terminatum	2	-99	5
Tricorythodes	1	1	
HEMIPTERA			
Belostoma	1	-99	
Microvelia		1	
Trichocorixa	3		
LIMNOPHILA			
Physella		-99	1
ODONATA			
Argia	1	3	2
Boyeria		-99	
Enallagma		2	
Gomphus	2	-99	
Hetaerina		-99	
Macromia		-99	
Nasiaeschna pentacantha		-99	
Progomphus obscurus	1		
TRICHOPTERA			
Cheumatopsyche			1
Nectopsyche	6	29	2
Oecetis	3	2	
Polycentropus		-99	
Pycnopsyche		-99	1
TUBIFICIDA			

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602621], Station #1, Sample Date: 3/22/2006 10:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Enchytraeidae			2
Tubificidae	1		
VENEROIDEA			
Sphaeriidae		2	

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602622], Station #2, Sample Date: 3/22/2006 4:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	1	8	1
COLEOPTERA			
Berosus	1	1	
Dineutus		-99	
Helichus lithophilus	1	1	
Neoporus	4		
Peltodytes	4		
DECAPODA			
Orconectes		1	
Orconectes immunis	-99		
DIPTERA			
Ablabesmyia	34	7	2
Ceratopogoninae	13	7	
Cladotanytarsus	4	3	
Cnephia		2	12
Corynoneura	2	3	4
Cricotopus bicinctus	13	43	4
Cricotopus/Orthocladius	5	28	8
Cryptochironomus	4	2	
Dicrotendipes	16	13	5
Gonomyia	1	1	
Hydrobaenus	3	3	3
Labrundinia	2	8	
Larsia		1	
Nanocladius		1	
Ormosia	2	2	
Paracladopelma	2		
Paraphaenocladius		4	2
Paratanytarsus	1	2	
Paratendipes	1		
Phaenopsectra		1	1
Polypedilum halterale grp		1	
Polypedilum illinoense grp	2	5	
Polypedilum scalaenum grp	1		
Procladius	1		
Rheotanytarsus	3	9	1
Saetheria	1		
Simulium	1	3	

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602622], Station #2, Sample Date: 3/22/2006 4:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Tanytarsus	40	36	2
Thienemanniella	1	3	1
Thienemannimyia grp.	1	8	2
EPHEMEROPTERA			
Acerpenna	1	2	
Baetisca lacustris			1
Caenis latipennis	89	80	
Callibaetis	1		
Centroptilum	1		
Hexagenia	2		
Leptophlebia	13	20	3
Stenacron	2	1	1
Stenonema femoratum	1	-99	
Stenonema terminatum	1		5
HEMIPTERA			
Trichocorixa	2		
LIMNOPHILA			
Physella		1	
ODONATA			
Argia	1	1	
Enallagma		-99	
Gomphus	-99	-99	
Hetaerina		-99	
Libellula	-99	-99	
Progomphus obscurus	3		
TRICHOPTERA			
Cheumatopsyche		1	1
Nectopsyche	5	10	
TUBIFICIDA			
Enchytraeidae	4	1	
Tubificidae	1		

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602623], Station #3, Sample Date: 3/22/2006 1:45:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	4	2	7
COLEOPTERA			
Berosus	1		
Dubiraphia	1		
Hydroporus	5	2	2
Laccophilus		1	
Ochthebius	1		
DECAPODA			
Orconectes virilis	-99		
DIPTERA			
Ablabesmyia	32	5	2
Ceratopogoninae	5		
Chrysops	1		
Cladotanytarsus	1		
Corynoneura	2	4	
Cricotopus bicinctus	23	46	32
Cricotopus/Orthocladius	12	2	6
Dicrotendipes	30	8	102
Dolichopodidae	1		
Glyptotendipes	1		
Gonomyia	2		
Hydrobaenus	6	9	4
Labrundinia	4	1	
Myxosargus	1		
Nanocladius		4	
Ormosia	3		
Paraphaenocladius	4	2	
Paratanytarsus		1	
Pericoma	1		
Phaenopsectra		2	
Polypedilum convictum grp			1
Polypedilum halterale grp	1		
Polypedilum illinoense grp		1	
Polypedilum scalaenum grp	1		
Procladius	3		
Rheotanytarsus	6	5	3
Saetheria	1		
Simulium		2	10

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602623], Station #3, Sample Date: 3/22/2006 1:45:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Stenochironomus			3
Stictochironomus	3		
Tanytarsus	54	59	14
Thienemanniella	1	2	
Thienemannimyia grp.	2	9	16
Tipula		1	
EPHEMEROPTERA			
Acerpenna	1	12	4
Caenis latipennis	119	59	52
Hexagenia limbata	4		
Leptophlebia	5	9	3
Paraleptophlebia		1	1
Stenacron			2
Stenonema femoratum	3		
Stenonema pulchellum			2
Stenonema terminatum	1		1
HEMIPTERA			
Belostoma		-99	
Microvelia		2	
Sigara		1	
Trichocorixa		1	
LEPIDOPTERA			
Cossidae	1		
LIMNOPHILA			
Fossaria	1		
ODONATA			
Argia	1		1
Enallagma		1	
Hetaerina		2	
Ischnura	1	1	
Macromia	1		
Progomphus obscurus	-99		
PLECOPTERA			
Perlidae	1		1
TRICHOPTERA			
Cheumatopsyche			3
Nectopsyche	7	3	1
TUBIFICIDA			
Enchytraeidae	2	2	
Tubificidae	1		

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602624], Station #4, Sample Date: 3/23/2006 9:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	6	16	4
COLEOPTERA			
Berosus	2		
Hydroporus	1	1	
Peltodytes		2	1
DIPTERA			
Ablabesmyia	26	5	1
Ceratopogoninae	8	2	
Cladotanytarsus	2	1	
Corynoneura	4	3	2
Cricotopus bicinctus	27	69	63
Cricotopus/Orthocladius	24	30	33
Cryptochironomus	1		
Dicrotendipes	11	5	41
Gonomyia	1		
Hemerodromia			1
Hydrobaenus		3	8
Labrundinia	4	4	
Nanocladius		2	
Ormosia	2	1	
Paraphaenocladius	1	3	1
Paratanytarsus	2	3	1
Pericoma	1	1	
Polypedilum convictum grp			1
Polypedilum fallax grp			2
Polypedilum illinoense grp	2		
Polypedilum scalaenum grp	2		3
Rheotanytarsus	4	5	6
Saetheria	1		2
Simulium		1	5
Stenochironomus			11
Tabanus	-99		
Tanypus	1		
Tanytarsus	24	21	32
Thienemanniella	1	3	1
Thienemannimyia grp.	2	10	27
EPHEMEROPTERA			
Acerpenna	1	8	18

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602624], Station #4, Sample Date: 3/23/2006 9:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Caenis latipennis	151	98	51
Centroptilum		1	
Hexagenia limbata	2	-99	
Leptophlebia	5	35	5
Stenonema terminatum		2	1
HEMIPTERA			
Trichocorixa		2	
LIMNOPHILA			
Physella	5	5	
ODONATA			
Hetaerina	2		
Ischnura		1	
Libellula	-99		
Progomphus obscurus	6		
TRICHOPTERA			
Cheumatopsyche	3	-99	5
Nectopsyche	2	3	1
Oecetis	1		
TUBIFICIDA			
Limnodrilus claparedianus	1		

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602625], Station #5, Sample Date: 3/23/2006 11:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	10	7	6
COLEOPTERA			
Agabus			1
Berosus			1
Chaetarthria			1
Enochrus		3	1
Helophorus			1
Hydroporus	16		
Laccobius			1
Laccophilus			1
Paracymus			2
Scirtidae		1	3
DIPTERA			
Ablabesmyia	45	15	24
Ceratopogoninae	37		
Chironomus	1		3
Cladotanytarsus	3		
Corynoneura	1		3
Cricotopus bicinctus	100	67	38
Cricotopus/Orthocladius	7		6
Cryptochironomus	1		
Dicrotendipes	58	10	32
Diptera	1		
Dolichopodidae	1		
Glyptotendipes	1		7
Gonomyia	1		2
Hemerodromia			1
Hydrobaenus	4	5	2
Labrundinia	6	10	
Larsia	5	2	
Nanocladius	3	1	1
Paralauterborniella		1	
Paraphaenocladius		4	
Paratanytarsus	4	7	6
Phaenopsectra	2	1	2
Polypedilum halterale grp	2		
Polypedilum illinoense grp	12	3	1
Polypedilum scalaenum grp	2		

Aquid Invertebrate Database Bench Sheet Report
Honey Ck [0602625], Station #5, Sample Date: 3/23/2006 11:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Procladius	1		1
Rheotanytarsus	5	13	1
Stenochironomus			4
Tabanus	2		
Tanytarsus	108	84	18
Thienemanniella	1		
Thienemannimyia grp.	3	13	9
undescribed Empididae			1
EPHEMEROPTERA			
Acerpenna			5
Caenis latipennis	316	88	108
Callibaetis	2		
Hexagenia limbata	2		
Leptophlebia	4	7	15
Stenonema femoratum	1		
Stenonema terminatum			1
HEMIPTERA			
Belostoma		1	
Sigara	3		
Trichocorixa	4		1
LIMNOPHILA			
Physella	2	18	9
ODONATA			
Argia	1	1	
Calopteryx		1	
Enallagma	-99		
Ischnura	1		
Libellula	-99		
Progomphus obscurus	1		
TRICHOPTERA			
Cheumatopsyche	1		2
Hydroptila	1		
Nectopsyche	1	1	
TUBIFICIDA			
Limnodrilus hoffmeisteri			2
Tubificidae			1
VENEROIDEA			
Sphaeriidae		3	1